Claims

1. A frequency synthesizing apparatus that synthesizes a plurality of frequencies based on a reference frequency, characterized by comprising:

complex sine wave generating means for generating complex sine waves by outputting complex amplitudes corresponding to eight phases in a complex plane; and

frequency switching means for performing frequency switching by performing complex number multiplication of the complex sine waves and the reference frequency.

2. The frequency synthesizing apparatus according to claim 1, characterized in that:

the complex sine wave generating means is constructed from two nonlinear DA converters having amplitudes {-1.7, -0.7, 0.7, 1.7}.

3. The frequency synthesizing apparatus according to claim 2, characterized by further comprising:

frequency division means that sequentially divides a sampling frequency of the nonlinear DA converter into 1/2; and

a decoder that decodes three bits outputted by 1/2, 1/4 and 1/8 frequency division of the sampling frequency and generates input data for the nonlinear DA converter.

4. The frequency synthesizing apparatus according to claim 3, characterized in that:

the decoder performs the decoding using frequency division outputs having a phase difference of 90 deg from each other if 1/4 and 1/8 frequency division is performed.

5. The frequency synthesizing apparatus according to claim 3, characterized in that:

the reference frequency is 4224 MHz, and 2112 MHz obtained by 1/2 frequency division of the reference frequency is the sampling frequency of the nonlinear DA converter;

the complex sine wave generating means outputs +264 MHz by incrementing +1 phase in a positive direction of phase in the complex plane, outputs -264 MHz by incrementing -1 phase in the positive direction of phase, outputs +792 MHz by incrementing +3 phases in the positive direction of phase, and outputs -792 by incrementing -3 phases in the positive direction of phase; and

the frequency switching means obtains desired frequencies by performing the complex number multiplication of the reference frequency and the respective outputted frequencies of the complex sine wave generating means.

6. The frequency synthesizing apparatus according to claim 3, characterized in that:

the frequency switching means obtains 4488 MHz, 3960 MHz and 3432 MHz, which are respective center frequencies forming a group A of a multiband OFDM_UWB system by performing complex number multiplication of the reference frequency and the respective outputted frequencies of the complex sine wave generating means.

7. The frequency synthesizing apparatus according to claim 6, characterized in that:

a frequency of 7128 MHz is further obtained in addition to 4224 MHz as a reference; and

the frequency switching means further obtains 7920 MHz, 7392 MHz, 6864 MHz and 6336 MHz which are respective center frequencies forming a group C of the multiband OFDM_UWB system

by selectively performing complex number multiplication of either reference frequency of 4224 MHz or 7128 MHz and the respective outputted frequencies of the complex sine wave generating means.

8. A frequency synthesizing method for synthesizing a plurality of frequencies based on a reference frequency, comprising:

a complex sine wave generation step of generating complex sine waves by outputting complex amplitudes corresponding to eight phases in a complex plane; and

a frequency switching step of performing frequency switching by performing complex number multiplication of the complex sine waves and the reference frequency.

9. The frequency synthesizing method according to claim 8, characterized in that:

the complex sine wave generation step is constructed from two sets of nonlinear DA conversion step having amplitudes of {-1.7, -0.7, 0.7, 1.7}.

10. The frequency synthesizing method according to claim 9, characterized by further comprising:

a frequency division step of sequentially dividing a sampling frequency into 1/2 in the nonlinear DA conversion step; and

a decoding step of decoding three bits outputted by 1/2, 1/4 and 1/8 frequency division of the sampling frequency and generates input data to the DA converter.

11. The frequency synthesizing method according to claim 10, characterized in that:

in the decoding step, the decoding is performed using

frequency division outputs having a phase difference of 90 deg from each other if 1/4 and 1/8 frequency division is performed.

12. The frequency synthesizing method according to claim 10, characterized in that:

the reference frequency is 4224 MHz, and 2112 MHz obtained by 1/2 frequency division of the reference frequency is the sampling frequency in the nonlinear DA conversion step;

in the complex sine wave generation step, +264 MHz is outputted by incrementing +1 phase in a positive direction of phase in the complex plane, -264 MHz is outputted by incrementing -1 phase in the positive direction of phase, +792 MHz is outputted by incrementing +3 phases in the positive direction of phase, and -792 MHz is outputted by incrementing -3 phases in the positive direction of phase; and

in the frequency switching step, desired frequencies are obtained by performing complex number multiplication of the reference frequency and the respective outputted frequencies in the complex sine wave generation step.

13. The frequency synthesizing method according to claim 10, characterized in that:

in the frequency switching step, 4488 MHz, 3960 MHz and 3432 MHz which are respective center frequencies forming a group A of a multiband OFDM_UWB system are obtained by performing complex number multiplication of the reference frequency and the respective outputted frequencies in the complex sine wave generation step.

14. The frequency synthesizing method according to claim 13, characterized in that:

a frequency of 7128 MHz is further obtained in addition

to 4224 MHz as a reference; and

in the frequency switching step, 7920 MHz, 7392 MHz, 6864 MHz and 6336 MHz which are respective center frequencies forming a group C of the multiband OFDM_UWB system are further obtained by selectively performing complex number multiplication of either reference frequency of 4224 MHz or 7128 MHz and the respective outputted frequencies in the complex sine wave generation step.